Applying Human Factors Insights to Free Flight Phase 2

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One important strength of the Free Flight Program is its attentiveness to human factors issues. From the very beginning, senior management recognized that advances in the management of air traffic depends as much on an understanding of the human dimension as on the sophistication and power of new technology.

As Phase 1 of the Free Flight Program nears completion, a comprehensive review was undertaken to identify those factors critical to success that are likely to be applicable to Phase 2. This paper presents new insights about what, in the view of those most closely involved in Phase 1, most contributed to acceptance of the new tools by those who operate and maintain the new tools.

This compilation is an extension of previous work that summarized the "lessons learned" in the Free Flight Program. Among the conclusions adduced from extensive observational and interview data were the following: (1) human factors assessments must begin early and be an ongoing activity with support from top-level FAA management; (2) acceptance of new tools requires that the products be user driven with an agreed upon concept of use; (3) strategies for adoption and deployment must be based on the fact that every site is different. Each tool may have to be adapted to fit the local situation and its introduction may uniquely alter the work practices of the controllers who use it there.

Several of these conclusions reappear in the following review, indicating the robustness of their generality.

METHOD

The Free Flight Human Factors Coordinator conducted structured and informal interviews with Air Traffic (AT) and Airway Facilities (AF) personnel who were directly involved with the field-testing and deployment of three Phase 1 technologies: User Request Evaluation Tool (URET), Traffic Management Advisor (TMA), and passive Final Approach Spacing Tool (pFAST). Additional information was elicited by questionnaires and informal group discussions. Supplemental interviews were conducted with human factors specialists, engineers, and program managers who worked on various stages of system design and development.

FINDINGS

The lessons learned from Phase 1 can be broadly categorized as factors that influenced controller use and acceptance, the importance of the initial site selection and site-unique issues, and the need to clearly define the roles and responsibilities of controllers, technicians, contractors, and managers.

Lessons learned about gaining controller acceptance

Tools should be introduced to the field at the point when the technology is mature enough to gain controller confidence. Even with the spiraling "build a little, test a little, deploy a little" approach, the prototype tool must be reasonably ready for adoption and offer clearly discernible benefits. Controllers expect new systems to be reliably accurate and flexible enough to handle the wide variety of situations that occur in actual operations. They should work as well, for example, in busy periods as when traffic volumes are low.

Ambiguity about the authorized use of new technology and the allocation of responsibility were two other sources of concern. An official FAA operational concept of use, developed before a tool is deployed beyond the prototype stage, gives controllers the certainty they need about how and when tools are to be used and by whom. Some require mandatory use by all controllers if they are to work as designed. Others may not. Management must take the initiative in deciding how and when a tool is to be used, taking into account a tool's accuracy and reliability.

Managers must also deal openly with suspicions that a new tool may pose a threat to job security. Winning union support is crucial to acceptance and depends on building a strong case that deployment of the tool is job enhancing, not job destroying.

Lessons learned about site selection and site-unique issues

The prototype needs to be a success story. Good news travels fast. Likewise, negative reports can quickly create widespread doubts about the tool. One way to ensure success is to select prototype sites with care. It is important to thoroughly evaluate local situations to choose those with the highest readiness for deployment.

Once deployment sites are selected, it is still necessary to assess the types and levels of support required if deployment is to succeed. Because each site is different, each will entail individualized planning and preparatory work that includes knowing what interface equipment is essential, what critical resources will be available, and what other activities at the site may coincide (and possibly conflict) with the scheduled installation and testing. Site adaptation, in particular, often requires a significant change in the level of involvement by site personnel.

Airway Facilities participants, in particular, emphasized the importance of preliminary site surveys that identify what needs to be in place if work is to proceed without complication. They recommended that detailed documentation be provided in advance of installation, specifying equipment requirements and interfaces.

While initial site selection is crucial, it is prudent to develop the prototype with more than a single site in mind. The unique characteristics of each site may hinder general adoption of a new tool if these differences are not recognized early in the design process. Later adaptation and site-by-site adjustment is costly and difficult. A pre-deployment analysis should determine how well the prototype would work at sites other than the one where it was developed.

Lessons learned about the importance of clarifying roles and responsibilities

The National Team is the central coordinating group set up to oversee the introduction of Free Flight technology throughout the NAS. The cadres working at the local sites look to the Team to establish priorities and provide guidance. For this arrangement to function properly, there must be a clear understanding of who is expected to make which decisions.

It is especially crucial that the roles and responsibilities of the National Team be clearly delineated. More specifically, all issues referred for Team consideration should be systematically tracked to ensure timely follow-through and resolution. To be fully effective, the Team should include NATCA and management representatives, as well as members from each deployment site and specialists recruited for their technical expertise.

Similar delineation is necessary at the sites. Ideally, local teams should be set up 18-24 months in advance of initial daily use. An early start allows time to make sure that the necessary support and resources from management and union are available, and to negotiate formal memoranda of understanding (MOU) when necessary. Sufficient lead-time is also needed for training and team development, so that members fully understand what is expected of them.

Airways Facilities technicians stressed the need for ongoing communication with the controllers so that the perspective of both AT and AF enters into the resolution of issues. The participation of Airway Facilities are best coordinated, they suggested, if dedicated personnel were assigned to Free Flight activities since it is very time consuming to write and review documents, attend meetings, and deal with the many technical and administrative matters that demand attention.

Clarity is also required in defining the roles and responsibilities of contractors. Installation and testing proceeds most efficiently when clear written guidelines spell out in advance how FAA personnel and on-site contractors are expected to work together. In addition, it was believed advisable to designate a contractor's technical representative at each site to monitor and evaluate contractor performance. Local cadres also recommended that contractors be allowed more time early in the project to observe ATC operations and how controllers do their jobs.

Once work is underway, excessive turnover in contractor personnel should be discouraged because continuity in staffing is important for successful, on-time completion. Changes in contracts and contractors confuse and disrupt relationships.

CONCLUSION

The new human factors insights gained during Phase 1 underscores the importance of cultivating a culture of collaboration that encompasses all who participate in the development and deployment of Free Flight technologies.

Management studies in the private sector have consistently found that collaboration brings real benefits: cost savings through the transfer of best practices, improved decision-making through the use of advice from across the organization, more innovation, and a greater capacity for concerted action among far-flung units of an enterprise.

The findings summarized in this paper confirm the critical importance of effective and sustained collaboration. One common theme runs through the various lessons learned: a willingness to seek and share information outside the immediate work group can significantly improve the prospects of successful development and deployment.

Attention to the human/human interface is instrumental in gaining controller confidence and acceptance, in selecting those sites most ready to provide optimum testing environments, and in clarifying the complex working relationships among the many individuals who contribute to the Free Flight Program.

It is the challenge of Free Flight management to build and maintain an effective network of collaboration that transcends organizational boundaries and promotes the timely circulation of mission-critical information and knowledge.